IS 8788 (2002): Dimensions for Metric External Taper and Internal Parallel Screw Threads [PGD 20: Engineering Standards]

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भारतीय मानक

मीटरी बाह्य टेपर और आंतरिक समानान्तर पेंच चूड़ी के लिए आयाम

(दूसरा पुनरीक्षण)

Indian Standard

DIMENSIONS FOR METRIC EXTERNAL TAPER AND INTERNAL PARALLEL SCREW THREADS

(Second Revision)

ICS 21.040.10

BUREAU OF INDIAN STANDARDS
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September 2002

Price Group 5

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Engineering Standards Sectional Committee, had been approved by the Basic and Production Engineering Division Council.

This standard was first published in 1978 and subsequently revised in 1993. This revision has been taken up for updating this standard incorporating the developments taken place in the field at international level.

In the preparation of this standard, assistance has been derived from DIN 158-1 : 1997 'Metric external screw threads — Part 1 : Nominal sizes, limits of size and verification' issued by DIN. Some more information is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

DIMENSIONS FOR METRIC EXTERNAL TAPER AND INTERNAL PARALLEL SCREW THREADS

(Second Revision)

1 SCOPE

This standard covers the basic profile, design, dimensions, tolerances and designation of metric external taper threads with mating internal parallel threads.

2 REFERENCES

The following Indian Standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
14962	ISO General purpose metric screw threads — Tolerances
(Part 1) : 2001	Principles and basic data
(Part 2) : 2001	Limits of sizes for general purpose external and internal screw threads — Medium quality
(Part 3) : 2001	Deviations for constructional screw threads

3 TERMINOLOGY

For the purpose of this standard, the terms, definitions and notations shall be as given in Table 1.

4 FORM OF SCREW THREADS

The basic form of metric external taper threads shall be as shown in Fig. 1.

5 DIMENSIONS

5.1 The nominal dimensions of external taper threads read with Fig. 1 shall be as given in Table 2.

5.2 The tolerances of external taper and internal parallel threads read with Fig. 2 shall be as given in Table 3.

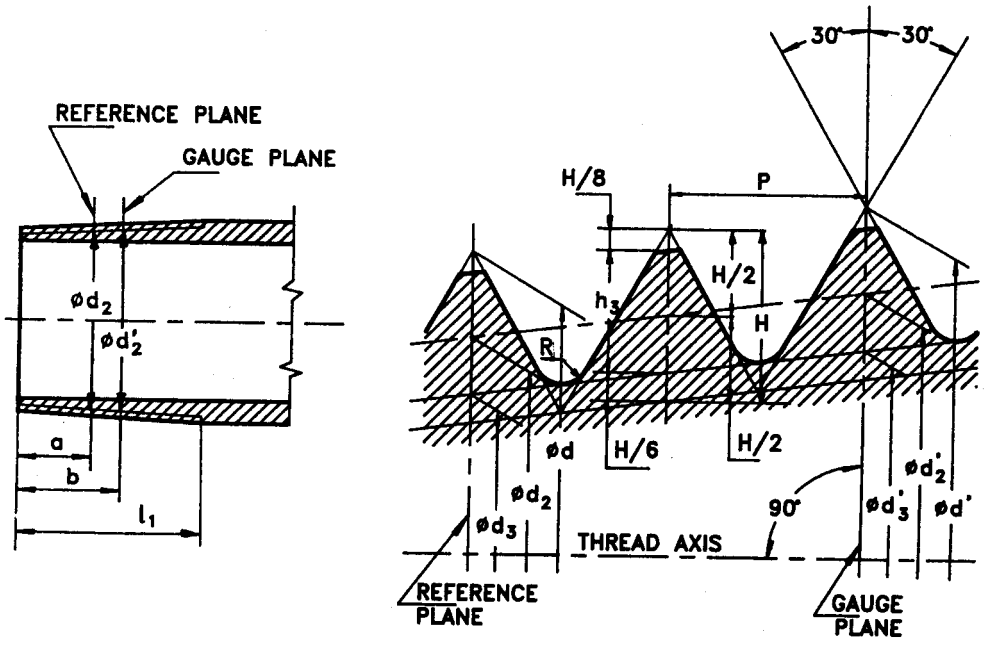
5.3 The limits of external threads in the gauge plane read with Fig. 2 shall be as given in Table 4.

Table 1 Terminology

(*Clause* 3)

Symbol	Explanation
(1)	(2)
a	Distance of reference plane from end
b	Distance of gauge plane from end
d	Major diameter of the external thread in reference plane
d_2	Pitch diameter of the external thread in reference plane
d_3	Minor diameter of the external thread in reference plane
D	Major diameter of the internal thread
D_1	Minor diameter of the internal thread
D_2	Pitch diameter of the internal thread
d'	Major diameter of the external thread in gauge plane
d'_2	Pitch diameter of the external thread in gauge plane
d'_3	Minor diameter of the external thread in gauge plane
H	Height of fundamental triangle
H_1	Covering of the thread pitch
h_3	Basic depth of external thread
l_1	Useful thread length of external thread
l_2	Useful thread length of internal thread
R	Thread root radius
P	Pitch
X	Thread run-out of external thread

5.4 The limiting dimensions for internal threads shall be as given in Table 5 read with Fig. 3. The values calculated are based on IS 14962 (Parts 1 to 3).



THREAD TAPER 1:16

$d_2 = d - 0.649\ 52\ P$

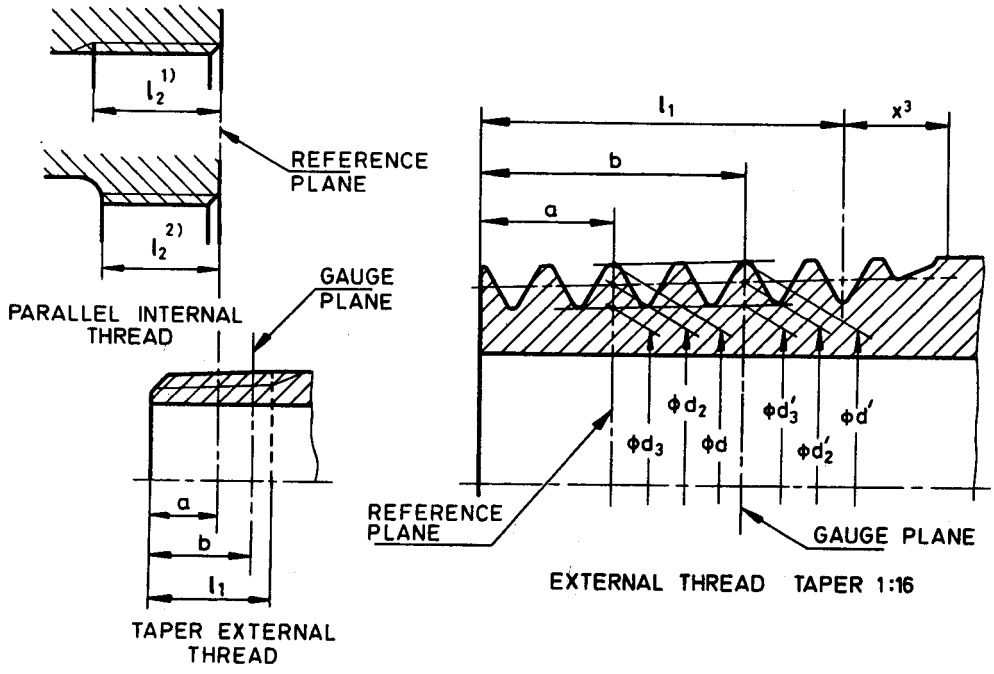
$d_3 = d - 1.226\ 87\ P$

$H = 0.866\ 03\ P$

$h_3 = 0.613\ 43\ P$

$R = \frac{H}{6} = 0.144\ 34\ P$

FIG. 1 EXTERNAL TAPER THREADS



1) An internal thread must permit the threading in of a taper external thread up to a useful thread length l_1.

2) In case of free thread run-out the useful thread length l_2 of the internal thread shall not be less than 80 percent of l_1.

3) $X = 1.5\ P$.

FIG. 2 LIMITS DEVIATIONS — PARALLEL INTERNAL THREADS AND EXTERNAL TAPER THREADS

Table 2 Nominal Dimensions of Metric External Taper Threads

(*Clause* 5.1)

All dimensions in millimetres.

Nominal Sizes	Pitch $P^{1)}$	Useful Thread Length l_1		Thread Depth h_3, *Max*		Dimensions in Reference Plane					Dimensions in Gauge Plane				
						Distance of Ref Plane a		Thread Dimensions in Ref Plane			Distance of Gauge Plane b		Thread Dimension in Gauge Plane		
		Normal	Short	Normal	Short	Normal	Short	Major dia $d = D$	Pitch dia $d_2 = D_2$	Minor dia d_3	Normal	Short	Major dia d'	Pitch dia d'_2	Minor dia d'_3
M_c 5	0.8	5	—	0.521	—	2	—	5	4.48	4.019	2.8	—	5.05	4.53	4.069
M_c 6	1	5.5	4	0.659	0.644	2.5	2	6	5.35	4.773	3.5	3	6.053	5.413	4.836
M_c 8 × 1								8	7.35	6.773			8.063	7.413	6.836
M_c 10 × 1								10	9.35	8.773			10.063	9.413	8.836
M_c 12 × 1								12	11.35	10.773			12.063	11.413	10.836
M_c 10 × 1.25	1.25	7	6	0.823	0.807	3	2.2	10	9.188	8.466	5	4.2	10.125	9.313	8.591
M_c 12 × 1.25								12	11.188	10.466			12.125	11.313	10.591
M_c 12 × 1.5	1.5	8.5	7.5	0.983	0.967	3.5	2.5	12	11.026	10.160	6.5	5.5	12.188	11.214	10.348
M_c 14 × 1.5								14	13.026	12.160			14.188	13.214	12.348
M_c 16 × 1.5								16	15.026	14.160			16.188	15.214	14.348
M_c 18 × 1.5								18	17.026	16.160			18.188	17.214	16.348
M_c 20 × 1.5								20	19.026	18.160			20.188	19.214	18.348
M_c 22 × 1.5								22	21.026	20.160			22.188	21.214	20.348
M_c 24 × 1.5								24	23.026	22.160			24.188	23.214	22.348
M_c 26 × 1.5								26	25.026	24.160			26.188	25.214	24.348
(M_c 27 × 1.5)								27	26.026	25.160			27.188	26.214	25.348
M_c 30 × 1.5								30	29.026	28.160			30.188	29.214	28.348

Table 2 (*Concluded*)

Nominal Sizes	Pitch $P^{1)}$	Useful Thread Length l_1		Thread Depth h_3, *Max*		Dimensions in Reference Plane					Dimensions in Gauge Plane				
						Distance of Ref Plane a		Thread Dimensions in Ref Plane			Distance of Gauge Plane b		Thread Dimension in Gauge Plane		
		Normal	Short	Normal	Short	Normal	Short	Major dia $d = D$	Pitch dia $d_2 = D_2$	Minor dia d_3	Normal	Short	Major dia d'	Pitch dia d'_2	Minor dia d'_3
(M_c 33 × 1.5)	1.5	10.5	9	1.014	0.983	4.5	3.4	33	32.026	31.160	8	6.9	33.219	32.245	31.379
M_c 36 × 1.5								36	35.026	34.160			36.219	35.245	34.379
M_c 38 × 1.5								38	37.026	36.160			38.219	37.245	36.379
(M_c 39 × 1.5)								39	38.026	37.160			39.219	38.245	37.379
M_c 42 × 1.5								42	41.026	40.160			42.219	41.245	40.379
M_c 45 × 1.5								45	44.026	43.160			45.219	44.245	43.379
M_c 48 × 1.5								48	47.026	46.160			48.219	47.245	46.379
M_c 52 × 1.5								52	51.026	50.160			52.219	51.245	50.379
M_c 27 × 2	2	12	10	1.321	1.290	5	4	27	25.701	24.546	9	8	27.250	25.951	24.796
M_c 30 × 2								30	28.701	27.546			30.250	28.951	27.796
M_c 33 × 2								33	31.701	30.546			33.250	31.951	30.796
M_c 36 × 2		13	11.5	1.342	1.302	6	4.8	36	34.701	33.546	10	8.8	36.250	34.951	33.796
M_c 39 × 2								39	37.701	36.546			39.250	37.951	36.796
M_c 42 × 2								42	40.701	39.546			42.250	40.951	39.796
M_c 45 × 2								45	43.701	42.546			45.250	43.951	42.796
M_c 48 × 2								48	46.701	45.546			48.250	46.951	45.796
M_c 52 × 2								52	50.701	49.546			52.250	50.951	49.796
M_c 56 × 2								56	54.701	53.546			56.250	54.951	53.796
M_c 60 × 2								60	58.701	57.546			60.250	58.951	57.796

NOTE — The size given in parentheses shall not be applied for new designs.

1) Pitch, P, is the distance between the profile centres measured parallel to the thread axes.

Table 3 Tolerance of Metric External Taper Threads

(*Clause* 5.2)

Nominal Size	a, b, l_1[1]		Major, Pitch and Minor Diameter of External Threads[2), 3)]	
	Normal	Short	Normal	Short
M_c 5	± 0.5	—	± 0.03	—
M_c 6 M_c 8 × 1 M_c 10 × 1 M_c 12 × 1	± 0.7	± 0.5	± 0.045	± 0.03
M_c 10 × 1.25 M_c 10 × 1.25	± 0.9	± 0.65	± 0.056	± 0.04
M_c 12 × 1.5 M_c 14 × 1.5 M_c 16 × 1.5 M_c 18 × 1.5 M_c 20 × 1.5 M_c 22 × 1.5 M_c 24 × 1.5 M_c 26 × 1.5 M_c 27 × 1.5 M_c 30 × 1.5	± 1	± 0.75	± 0.063	± 0.047
M_c 33 × 1.5 M_c 36 × 1.5 M_c 38 × 1.5 M_c 39 × 1.5 M_c 42 × 1.5 M_c 45 × 1.5 M_c 48 × 1.5 M_c 52 × 1.5 M_c 27 × 2 M_c 30 × 2 M_c 33 × 2	± 1.5	± 1	± 0.094	± 0.063
M_c 36 × 2 M_c 39 × 2 M_c 42 × 2 M_c 45 × 2 M_c 48 × 2 M_c 52 × 2 M_c 56 × 2 M_c 60 × 2	± 1.8	± 1.2	± 0.115	± 0.075

[1)]The tolerance for '*a*' (distance of reference plane) and '*b*' (distance of gauge plane) can only be used together with thread nominal dimensions as per Table 1.

[2)]The tolerances apply for external pitch diameter and minor diameter in every cross-section perpendicular to the thread axis within the useful thread length l_1. The tolerance zone thus lies parallel to the surface generating line of the nominal taper.

[3)]The tolerances for major pitch and minor diameters are only valid, if the threads are measured. For the distance '*a*' and '*b*', then only nominal dimensions hold good.

Table 4 Limits for External Threads in the Gauge Plane

(*Clause* 5.3)

All dimensions in millimetres.

Nominal Size	Normal Type						Short Type					
	Major Dia		Pitch Dia		Minor Dia		Major Dia		Pitch Dia		Minor Dia	
	d', Max	*d', Min*	d'_2, *Max*	d'_2, *Min*	d'_3, *Max*	d'_3, *Min*	*d', Max*	*d', Min*	d'_2, *Max*	d'_2, *Min*	d'_3, *Max*	d'_3, *Min*
M_c 5	5.08	5.02	4.56	4.50	4.099	4.039	—	—	—	—	—	—
M_c 6	6.108	6.018	5.458	5.368	4.881	4.791	6.093	6.033	5.443	5.383	4.866	4.806
M_c 8 × 1	8.108	8.018	7.458	7.368	6.881	6.791	8.093	8.033	7.443	7.383	6.866	6.806
M_c 10 × 1	10.108	10.018	9.458	9.368	8.881	8.791	10.093	10.033	9.443	9.383	8.866	8.806
M_c 12 × 1	12.108	12.018	11.458	11.368	10.881	10.791	12.093	12.033	11.443	11.383	10.866	10.806
M_c 10 × 1.25	10.181	10.069	9.369	9.257	8.647	8.535	10.165	10.085	9.353	9.273	8.631	8.551
M_c 12 × 1.25	12.181	12.069	11.369	11.257	10.647	10.535	12.165	12.085	11.353	11.273	10.631	10.551
M_c 12 × 1.5	12.251	12.125	11.277	11.151	10.411	10.285	12.235	12.141	11.261	11.167	10.395	10.301
M_c 14 × 1.5	14.251	14.125	13.277	13.151	12.411	12.285	14.235	14.141	13.261	13.167	12.395	12.301
M_c 16 × 1.5	16.251	16.125	15.277	15.151	14.411	14.285	16.235	16.141	15.261	15.167	14.395	14.301
M_c 18 × 1.5	18.251	18.125	17.277	17.151	16.411	16.285	18.235	18.141	17.261	17.167	16.395	16.301
M_c 20 × 1.5	20.251	20.125	19.277	19.151	18.411	18.285	20.235	20.141	19.261	19.167	18.395	18.301
M_c 22 × 1.5	22.251	22.125	21.277	21.151	20.411	20.285	22.235	22.141	21.261	21.167	20.395	20.301
M_c 24 × 1.5	24.251	24.125	23.277	23.257	22.411	22.285	24.235	24.141	23.261	23.167	22.395	22.301
M_c 26 x 1.5	26.251	26.125	25.277	25.151	24.411	24.285	26.235	26.141	25.261	25.167	24.395	24.301
(M_c 27 × 1.5)	27.251	27.125	26.277	26.151	25.411	25.285	27.235	27.141	26.261	26.167	25.395	25.301
M_c 30 × 1.5	30.251	30.125	29.277	29.151	28.411	28.285	30.235	30.141	29.261	29.167	28.395	28.301
(M_c 33 × 1.5)	33.313	33.125	32.339	32.151	31.473	31.285	33.282	33.156	32.308	32.182	31.442	31.316
M_c 36 × 1.5	36.313	36.125	35.339	35.151	34.473	34.285	36.282	36.156	35.308	35.182	34.442	34.316

M_c 38 × 1.5	38.313	38.125	37.339	37.151	36.473	36.285	38.282	38.156	37.308	37.182	36.442	36.316
(M_c 39 × 1.5)	39.313	39.125	38.339	38.151	37.473	37.285	39.282	39.156	38.308	38.182	37.442	37.316
M_c 42 × 1.5	42.313	42.125	41.339	41.151	40.473	40.285	42.282	42.156	41.308	41.182	40.442	40.316
M_c 45 × 1.5	45.313	45.125	44.339	44.151	43.473	43.285	45.282	45.156	44.308	44.182	43.442	43.316
M_c 48 × 1.5	48.313	48.125	47.339	47.151	46.473	46.285	48.282	48.156	47.308	47.182	46.442	46.316
M_c 52 × 1.5	52.313	52.125	51.339	51.151	50.473	50.285	52.282	52.156	51.308	51.182	50.442	50.316
M_c 27 × 2	27.344	27.156	26.045	25.857	24.89	24.702	27.313	27.187	26.014	25.888	24.859	24.733
M_c 30 × 2	30.344	30.156	29.045	28.857	27.89	27.702	30.313	30.187	29.014	28.888	27.859	27.733
M_c 33 × 2	33.344	33.135	32.045	31.857	30.89	30.702	33.313	33.187	32.014	31.888	30.859	30.733
M_c 36 × 2	36.365	36.135	35.066	34.836	33.911	33.681	36.325	36.175	35.026	34.876	33.871	33.721
M_c 39 × 2	39.365	39.135	38.066	37.836	36.911	36.681	39.325	39.175	38.026	37.876	36.871	36.721
M_c 42 × 2	42.365	42.135	41.066	40.836	39.911	39.681	42.325	42.175	41.026	40.876	39.871	39.721
M_c 45 × 2	45.365	45.135	44.066	43.836	42.911	42.681	45.325	45.175	44.026	43.876	42.871	42.721
M_c 48 × 2	48.365	48.135	47.066	46.836	45.911	45.681	48.325	48.175	47.026	46.876	45.871	45.721
M_c 52 × 2	52.365	52.135	51.066	50.836	49.911	49.681	52.325	52.175	51.026	50.876	49.871	49.721
M_c 56 × 2	56.365	56.135	55.066	54.836	53.911	53.681	56.325	56.175	55.026	54.876	53.871	53.721
M_c 60 × 2	60.365	60.135	59.066	58.836	57.911	57.681	60.325	60.175	59.026	58.876	57.871	57.721

6 DESIGNATION

The metric external taper thread and internal parallel thread conforming to this standard shall be designated as follows:

An external taper thread having nominal size 30 mm and pitch 2 mm with useful thread length in normal type shall be designated as:

$$\text{IS } 8788 - M_c\, 30 \times 2$$

An external taper thread having nominal size 30 mm and pitch 2 mm with useful thread length in short type shall be designated as:

$$\text{IS } 8788 - M_c\, 30 \times 2 - \text{Short}$$

An internal parallel thread having nominal size 30 mm and pitch 2 mm of tolerance class 4H for pitch diameter and tolerance class 5H for minor diameter shall be designated as:

$$\text{IS } 8788 - M\, 30 \times 2 - 4H5H$$

7 INSPECTION

The taper external threads are inspected in industry mostly by the use of commercial thread gauges. The end face of the threaded portion is pressed against a stop and the limits of size of the screw thread at the gauge plane are then determined. With this method of inspection the limit deviations for distances *a* and *b* (*see* Table 3) are disregarded. These distances count as theoretically exact dimensions.

When selecting the gauge type, the user is to take the thread parameters to be checked into account. When all the thread parameters have to be checked, taper thread ring gauges are to be used. Parallel thread ring gauges are adequate if only the function of the thread at the gauge plane is to be checked. In this case, however, errors of taper angle and pitch angle cannot be detected. For both types of gauge, the width of the thread ring gauges is to be correlated with distance *b* for the normal or short form. During inspection, the work piece thread is to be run into the ring gauge and the distance between the end face of the work piece thread and the face of the thread ring gauge determined. The thread ring gauges can be provided with step faces for this purpose. The end face of the work piece thread shall lie between the minimum and maximum step faces.

Removal of the incomplete thread in parallel ring gauges may influence the inspection result.

Thread diameters are normally measured at the gauge plane. However, in order to detect any crowning that may be present, the thread dimensions may be checked additionally at the reference plane.

The inspection-methods described above may lead to different results, meaning rejection can be the result in marginal cases. It is therefore recommended that agreement on inspection procedure be reached between manufacturers and users of work pieces having this type of thread.

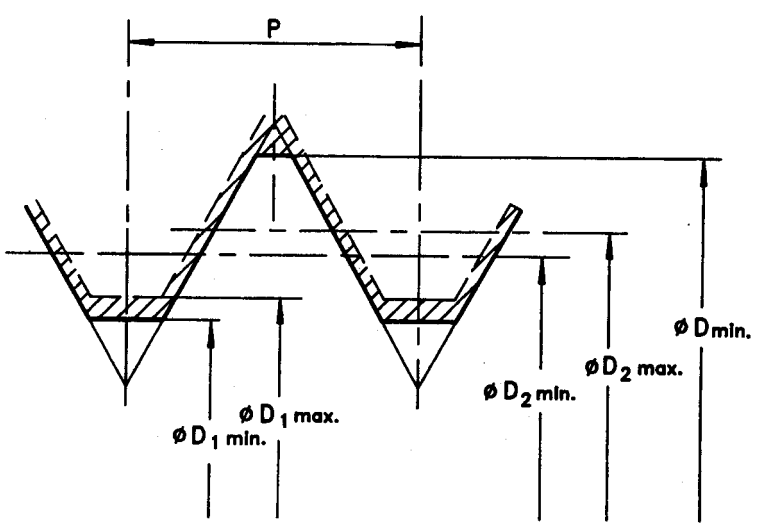


FIG. 3 NUTS THREADS TOLERANCE POSITION *H*

Table 5 Limiting Dimensions for Internal Threads

(*Clause* 5.4)

All dimensions in millimetres.

Thread Size	Major Diameter	Pitch Diameter 4H		Minor Diameter 5H	
	D_{Min}	D_{2Min}	D_{2Max}	D_{1Min}	D_{1Max}
M 5	5	4.480	4.560	4.134	4.294
M 6	6	5.350	5.445	4.917	5.107
M 8 × 1	8	7.350	7.445	6.917	7.107
M 10 × 1	10	9.350	9.445	8.917	9.107
M 12 × 1	12	11.350	11.450	10.917	11.107
M 10 × 1.5	10	9.188	9.288	8.647	8.859
M 12 × 1.25	12	11.188	11.300	10.647	10.859
M 12 × 1.5	12	11.026	11.144	10.376	10.612
M 14 × 1.5	14	13.026	13.144	12.376	12.612
M 16 × 1.5	16	15.026	15.144	14.376	14.612
M 18 × 1.5	18	17.026	17.144	16.376	16.612
M 20 × 1.5	20	19.026	19.144	18.376	18.612
M 22 × 1.5	22	21.026	21.144	20.376	20.612
M 24 × 1.5	24	23.026	23.151	22.376	22.612
M 26 × 1.5	26	25.026	25.151	24.376	24.612
M 27 × 1.5	27	26.026	26.151	25.376	25.612
M 30 × 1.5	30	29.026	29.151	28.376	28.612
M 33 × 1.5	33	32.026	32.151	31.376	31.612
M 36 × 1.5	36	35.026	35.151	34.376	34.612
M 38 × 1.5	38	37.026	37.151	36.376	36.612
M 39 × 1.5	39	38.026	38.151	37.376	37.612
M 42 × 1.5	42	41.026	41.151	40.376	40.612
M 45 × 1.5	45	44.026	44.151	43.376	43.612
M 48 × 1.5	48	47.026	47.158	46.376	46.612
M 52 × 1.5	52	51.026	51.158	50.376	50.612
M 27 × 2	27	25.701	25.841	24.835	25.135
M 30 × 2	30	28.701	28.841	27.835	28.135
M 33 × 2	33	31.701	31.841	30.835	31.135
M 36 × 2	36	34.701	34.841	33.835	34.135
M 39 × 2	39	37.701	37.841	36.835	37.135
M 42 × 2	42	40.701	40.841	39.835	40.135
M 45 × 2	45	43.701	43.841	42.835	43.135
M 48 × 2	48	46.701	46.851	45.835	46.135
M 52 × 2	52	50.701	50.851	49.835	50.135
M 56 × 2	56	54.701	54.851	53.835	54.135
M 60 × 2	60	58.701	58.851	57.835	58.135

ANNEX A

(*Foreword*)

A-1 EXPLANATIONS

The taper external thread is made with a nominal taper 1 : 16 and the thread profile is perpendicular to the thread axis.

The combination of external taper thread with internal parallel threads is more economical since a parallel internal thread is easier to make. Taking into account thin walled parts where a short thread length is required, a short form has been standardized in addition to normal form.

The nominal dimensions in Table 2 are valid for dimensions perpendicular to the axis in the reference plane or gauge plane. The limiting deviations for thread diameter are given by the formulae:

$$A_g = \pm A_a . C \; (C = 1 : 16)$$

$$A_g = \pm A_a / 16$$

where

A_g = thread diameter,

A_a = tolerance for the distance '*a*' in the reference plane or '*b*' in the measuring/gauging plane, and

C = taper ratio.

In this revision, the following changes have been made:

The taper external threads as per this standard are produced predominantly by 'rolling'. During rolling cylindrical shape or taper screw thread occurs, due to which taper in the functionally important portion cannot be measured.

Therefore, a new gauge plane in addition to reference plane (which was earlier called as gauge plane) is introduced which now lies in the functionally important area.

The values for the depth of threading h_3 have been calculated in Table 2 after taking limit deviations as per Table 3 into consideration and they have been stated separately for standard design as well as short-term design.

Table 1 has been added for terminology and symbols.

In Table 5, '4H5H column 1' has been deleted since the information that tolerances clause is 4H for thread pitch diameter and 5H for the minor diameter of internal screw thread are already covered in column 3 and 4.

Under Fig. 2, additional foot note 3 '$X = 1.5\,P$' has been added.

A-2 USAGE

Metric taper external and parallel internal threads as per this standartd are used for self sealing connections in cases where such sealing cannot be advantageously obtained by a parallel thread connection with sealing washer.

This standard gives nominal sizes, limits deviation, limits of sizes as well as inspections.

Taper external threads are used in screw plugs, threaded bushing and sockets and taper threads of short form in lubricating nipples.

In effective media such as oils, other liquids and gases, a light threaded connection up to a nominal diameter of 26 mm can be achieved without any sealant. For nominal diameter above 26 mm, the use of sealant in the screw threads is recommended.

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This Indian Standard has been developed from Doc : No. BP 20 (0186).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Printed at New India Printing Press, Khurja, India